has since shown[1] that the increased density of the jet on electrification is only partly due to the cause to which I attribute it, namely, the electrical repulsion preventing the coalescence of the drops, as he proves that the electrification of the jet overpowers the surface tension, and so promotes the formation of small drops, and in this way assists in increasing the density of the condensation.

Mr. Bidwell's misunderstanding of my position is greatly due to an impression he seems to have that I attribute all cloudy condensation to the presence of dust particles. Now, if he will turn to my first paper on this subject,[2] he will find that the effect of the vapours of hydrochloric, sulphuric, and nitric acids, *active* vapours, mentioned in his lecture, have all been referred to, and experimented with, as well as many other substances, so that I was well aware of these causes of condensation. Further, he will find in the paper referred to, as well as in another of a later date,[3] that it is possible to produce cloudy condensation without the presence either of dust or a vapour capable of forming a nucleus with water vapour, or even the abnormal condition due to electrification, all that is necessary being a sufficiently high degree of supersaturation.

Darroch, Falkirk. JOHN AITKEN.

The Os Pedis in Ungulates.

PROF. EWART, in a recent paper,[4] describes the os pedis or "coffin bone" of the horse as consisting to a large extent of a bony cap developed from connective tissue around, and quite independent of the terminal phalanx. This throws an entirely new light on one of the most remarkable bones of the horse's skeleton, and is especially interesting to veterinarians. Having a fœtal calf (about 6½ months) in my possession, I was led, on reading Ewart's paper, to examine the digits, and wish now, in a word, to state the result.

I found each digit provided with a bony cap similar to that figured by Ewart from his 35 c.m. horse embryo. On making a longitudinal vertical section of one of the digits, the investing cap could easily be distinguished from the phalanx proper; and, further, I noticed a large deposit of osseous matter in what may be termed the diaphysis (shaft) of the terminal phalanx, and an indication of a second ossific centre at its apex. This affords additional proof that the third phalanx in ungulates, as in man, consists partly of membrane bone and partly of cartilage bone, and that it in all probability develops from several centres.

I hope soon to publish a number of observations on the structure and development of the digits in ungulates.

A. E. METTAM.

Royal Veterinary College, Edinburgh.

A Brilliant Meteor.

A METEOR of extraordinary splendour was seen here this evening at 7.45. It appeared vertically under the Pole star, at an elevation of 40°, and, after pursuing a path that sloped down to the west at an angle of 30°, disappeared silently under Cassiopeia.

The incandescent mass had an apparent volume equal to that of a good-sized orange. It gave out a bluish-white light that brilliantly lit up, for about four seconds, the grounds and buildings of the College.

The glowing mass was followed by a long, conical, crimson train ending in a wisp of condensed vapour resembling smoke.

The sky was clear, starlit, and moonless at the time.

M. F. O'REILLY.

The Training College, Waterford, January 31.

THE VATICAN OBSERVATORY.

THE report recently issued by the Vatican Observatory (*Pubblicazioni della Specola Vaticana*, Fasciculus iii.) is the best that has been prepared by Father Denza, and in abundance of matter and fineness of execution, it compares favourably with that of any observatory. The first report was published in 1891, but neither that nor the one of 1892 contains so much evidence of work done as the bulky tome last issued. The observatory, as it is at present constituted, only dates back to 1889; but previous to that, it passed through so many vicissitudes that a brief outline of its history may be of interest.

It is recorded that an observatory tower was erected by Pope Gregory XIII. in connection with the reform of the calendar, some time previous to 1582. The tower was intended for astronomical observation, and there is every reason to suppose it was the first celestial watch-tower built in Rome. The following translation of an extract from the *Nautica Mediterranea* of B. Crescenzi, published in Rome in 1607, clearly shows that the room at the top of the tower was used for astronomical purposes:—"When the sun arrives at the tropic of Cancer its rays enter a little hole which Ignatius Danti has had made for that purpose in the roof of the apartment which Pope Gregory XIII. had erected upon the Belvedere Gallery, and the rays only enter the hole once a year, when the sun is furthest from the equinox, after which he turns and goes back." Danti appears to have marked a meridian line upon a marble table in the tower, and meridian observations were made until about 1644, but the observatory was afterwards neglected, and remained so for about a century and a half. It was only towards the end of the last century that an attempt was made to renew the astronomical work. Cardinal Zelada had a large meridian circle constructed, and furnished the observatory with some good astronomical instruments, among which was a telescope by Dollond. As the observatory was not available for public instruction, it was decided to establish another at the Roman College, and the new observatory was erected in 1787, though observations had been carried on at the College long before.

In 1789 the Vatican Observatory commenced a new epoch in its history. Philip Gili began his directorship in that year, and, in addition to making astronomical observations, initiated researches in magnetism and meteorology, and other branches of terrestrial physics. The observatory kept well apace with the times until the death of Gili in 1821, but after that it became quite disorganised. All the instruments and records were dispersed, and the observatory itself was entirely deserted until about 1870, when it was transformed into a residence.

Before passing to the third epoch in the "eventful history" of the Vatican Observatory, a few remarks upon the Observatory of the Roman College may be of interest, especially as the relations between the two institutions are not generally well understood among astronomers. According to Father Cortie, who has kindly furnished most of the following information upon this matter, the Roman College Observatory dates back at least to 1572. It belonged to the Society of Jesus, and consisted in the beginning of a few rooms set aside for astronomical studies. Scheiner, of sun-spot fame, Clavius, the author of the Gregorian reform of the calendar and the observer of Tycho Brahé's Nova of 1572, de Gottingues, who observed Jupiter's spots and the comets of 1664, 1665, and 1668, Boscovich, and other renowned astronomers were connected with it. There still exists in the Kircher Museum of the College a meridian line traced by Boscovich, and the same astronomer drew up the plans for a new observatory, but they were never carried into effect, on account of the troubles in France and Spain, during which the Society of Jesus was suppressed. During the period of the suppression, the observatory was directed at first by J. Callandrelli, who in 1773 built a square tower at the eastern angle of the facade of the College, and placed in it a zenith-sector and a meridian circle, the gifts of Cardinal Zelada and Pope Pius VII.

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[1] *Phil. Mag.* October, 1893.

[2] "Dust, Fogs, and Clouds." (*Trans.* Roy. Soc. Edin., vol. xxx. part i.)

[3] "On the Numbers of Dust Particles in the Atmosphere." (*Trans.* Roy. Soc. Edin. vol. xxxv. part i.)

[4] "The Development of the Skeleton of the Limbs of the Horse." (*Journal of Anatomy and Physiology*, January, 1894.)

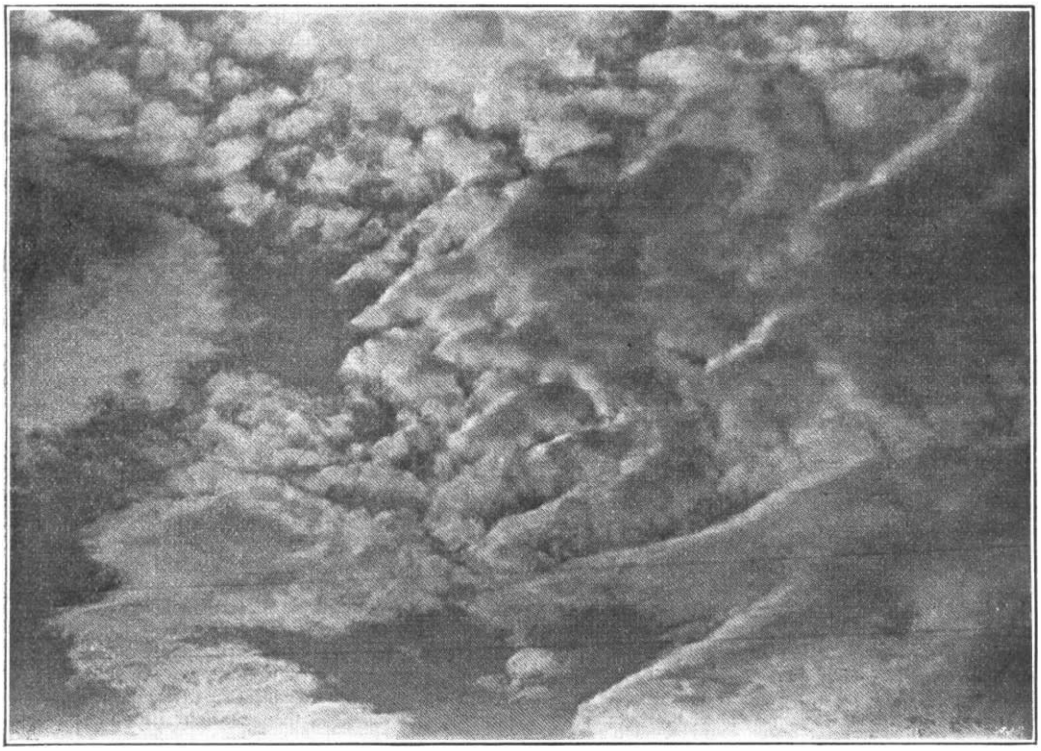

FIG. 1.—Alto-Cumulus.

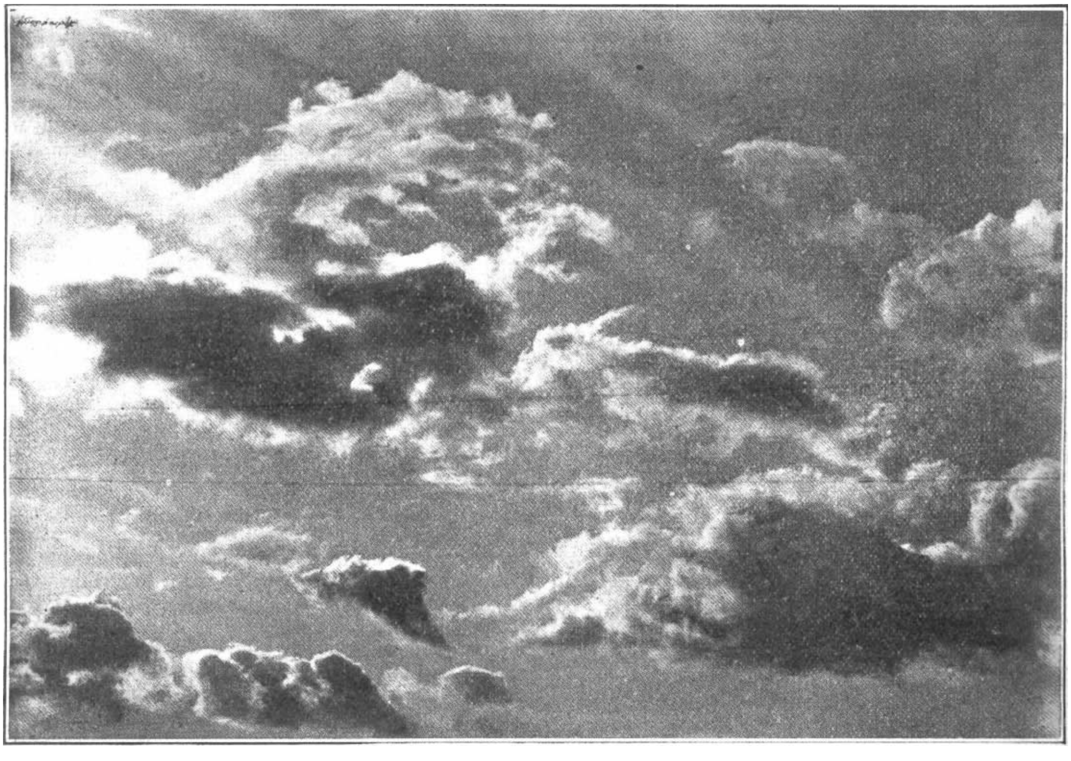

FIG. 2.—Strato-Cumulus and Alto Stratus.

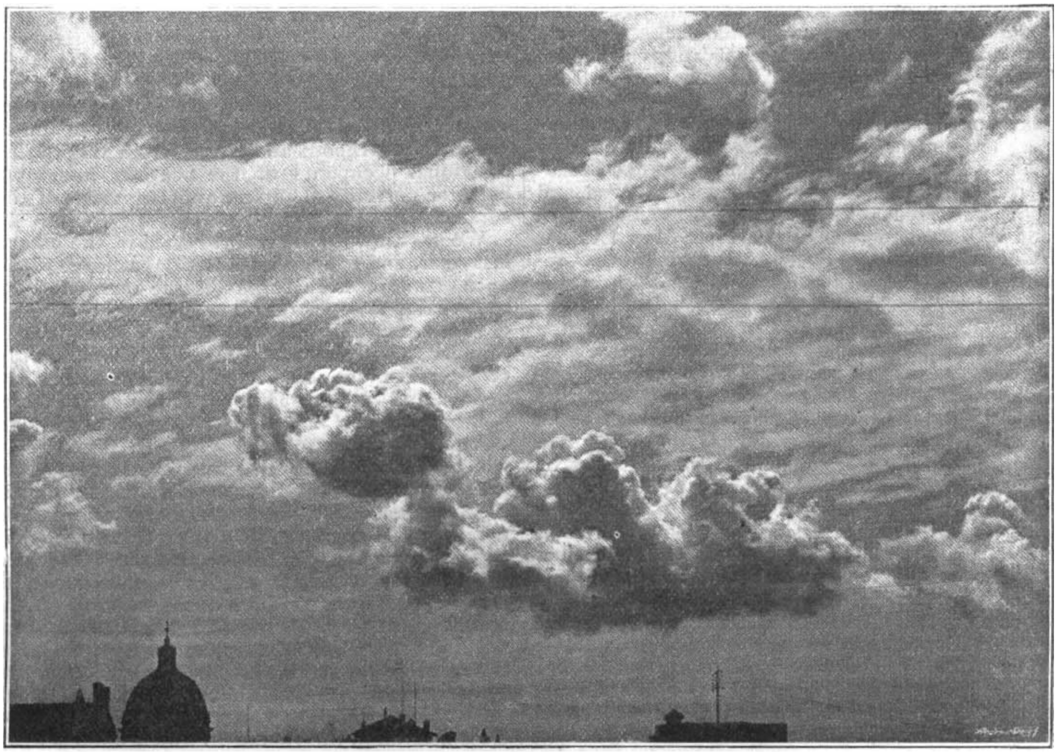

FIG. 3.—Cumulus and Strato-Cumulus.

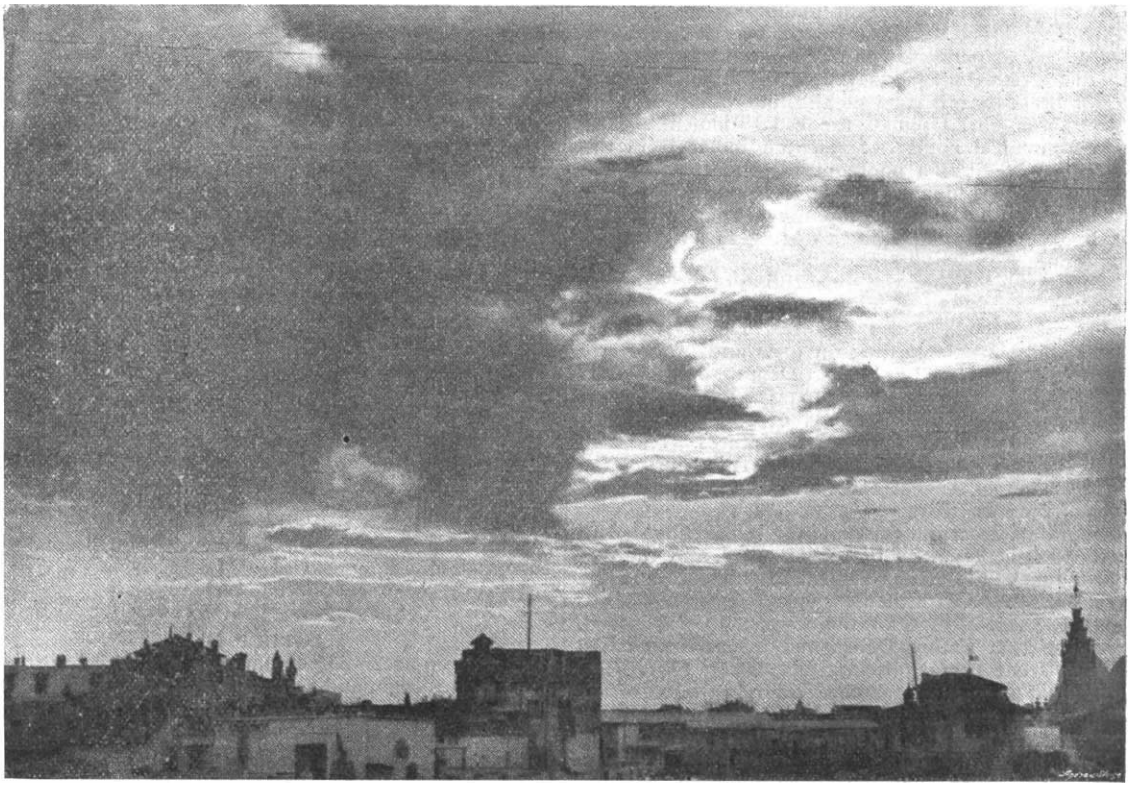

FIG. 4.—Nimbus.

After the restoration of the Society, however, the Jesuits gained possession of this observatory in 1824, and placed it under the direction of Dumouchel. De Vico, whose cometary discoveries and observations of Venus are so well known, was the next director, but with the troubles of 1848 came the expulsion of the Society of Jesus from Rome. De Vico died in London. In 1849, however, Secchi, who made his first observation when an exile at Stonyhurst, commenced to carry out the learned Boscovich's plans. The observatory was rebuilt, endowed, and instruments furnished at the expense of the Society of Jesus, and with the generous aid of Pope Piux IX. At the next expulsion of the Society, in 1870, Secchi remained at the observatory at the express wish of the Italian Government. At his death he bequeathed the property of the Society to Father Ferrari, but the Government appropriated the observatory and everything connected with it. Fortunately for astronomy, however, Signor Tacchini was appointed to the directorship of the observatory, and has well sustained its reputation. It may be added that the Observatory of the Capitol, in which Respighi did such good work, was founded by Leo XII., and attached to the University of Rome.

After the Vatican Exposition in 1888, in commemoration of the fiftieth anniversary of the priesthood of Pope Leo XIII., all the instruments and apparatus given by members of the Roman Catholic Church interested in celestial and terrestrial physics were brought together, and it occurred to the managers of the science sections of the Exposition that they would find a suitable home in the old Gregorian tower. The suggestion was warmly approved and carried into effect. Father Denza, a great friend of Secchi's, was appointed the director of the revived observatory, and he began his work in 1889 with a comprehensive programme, which he and his assistants Lais, Andreis, and Mannucci have well carried out. The investigations instituted relate to meteorology, terrestrial magnetism, geodynamics, and astronomy. The building is well situated for meteorological observations; it is equipped with instruments for the continuous record, as well as personal observation, of meteorological data. In terrestrial magnetism, also, instruments are provided for the determination of absolute values and the registration of variations of the usual elements. The chief astronomical engine of research included in the observatory's outfit is a photographic equatorial of the Henry pattern and mounting, for use in connection with the construction of the photographic star-chart which the Vatican Observatory is helping to bring to a successful termination.

Having now described the constitution of the observatory, it remains for us to state the nature of the work done, as evidenced by the reports. The first report contains a long article on the principles and progress of celestial photography, by Father Denza. Father Lais reports the details of stellar photography in connection with the chart, and the methods of obtaining photographic stellar spectra and solar pictures. He also summarises the observations made in Italy during the Perseid shower of August 1890, and during the Leonid shower of the same year.

Sig. Andreis describes the points to be investigated in the geodynamical work of the observatory, and there is a full account of the meteorological instruments and the observations made with them.

When the second report of the observatory was issued, it was seen that Father Denza and his assistants had carried on some useful observations during 1891. The geographical position of the observatory, eclipses of the sun and moon, the Perseid and Leonid meteor showers of the year, formed the subjects of important articles by the Director, while Father Lais and Sig. Mannucci described the work that had been done in celestial photography. Marvellous results were obtained with the Henry equatorial from the very beginning, and no stronger witness of this is necessary than that afforded by the beautiful plates which embellish the second report. The picture of the Ring Nebula in Lyra is certainly one of the best yet obtained, and that of the star-cluster M 15 is equally good. Other bits of celestial scenery included in the same volume are the Pleiades and neighbourhood, and a cluster in Sagittarius, while individual occupants of the heavens are represented by three portraits of Jupiter and two views of the lunar surface.

We pass now to the report issued in the latter half of last year, and which in point of excellence and abundance of matter even surpasses the one before it. Two remarkably fine portraits are given in this volume, one of Pope Leo XIII., the other of the late Admiral Mouchez; and the astronomical views include the region of Nova Aurigæ, that of the Praesepe cluster, the Orion nebula, and four sun-pictures. But none of these photographs are so striking as the fourteen reproductions of cloud photographs obtained by Sig. Mannucci, and of which we are able to give four specimens. Meteorologists will remember that a set of eighty cloud photographs taken at the Vatican Observatory were shown at the Royal Meteorological Society's Exhibition in 1890. Sig. Mannucci's experience indicates that in cloud photography very short exposures do not give the best results. Plates of medium rapidity, having a thin film, seem to give the boldest contrast between the blue of the sky and the masses of diaphanous haze that are sometimes projected upon it. Such plates also show the greatest amount of detail in large masses of cloud.

Sig. Mannucci gives a brief account of systems of cloud classification in the volume to which reference has been made. He practically accepts the classification proposed by Abercromby and Hildebrandsson at the International Conference held in Munich in 1891, and set forth in the Cloud-Atlas of Hilderbrandsson, Köppen, and Neumayer. The classification recognises ten different species arranged in five principal groups. The first group (A) comprises the highest clouds in our atmosphere; the second group (B) includes clouds at a medium height, and the third (C) low clouds. In the fourth (D) we have clouds in ascending currents, and finally, (E) contains the masses of vapour changing in form. In the first four groups the letter (*a*) is used to distinguish the forms of cloud usually accompanied by fine weather, and (*b*) for those characteristic of bad weather. The following is the grouping as given by Sig. Mannucci:—

GROUP A.

Clouds from medium altitudes up to an average of 9000 metres.

1. Cirrus (*a*)
2. Cirro-stratus (*b*)
3. Cirro-cumulus

GROUP B.

Clouds having altitudes from 3000 to 6000 metres.

4. Alto-cumulus (*a*
5. Alto-stratus (*b*)

GROUP C.

Clouds the bases of which have altitudes from 1000 to 2000 metres.

6. Strato-cumulus (*a*)
7. Nimbus (*b*)

GROUP D.

Clouds on ascending columns of air, with bases about 1400 metres high, and summits from 3000 to 5000 metres.

8. Cumulus (*a*)
9. Cumulo-nimbus (*b*)

GROUP E.

Fogbanks up to about 1,500 metres.

10. Stratus

We cannot conclude this account without referring to the magnetic work done at the observatory. Father Denza contributes to the third report a long discussion of the magnetic declination and inclination at Rome, and, by a comparison of observations, finds the secular variations. In the latter half of the seventeenth century, the declination was about two and one-half degrees West, and increasing. In 1806, Gili obtained a value of 17° 17′, and in 1824 a maximum of 18° seems to have been reached. The declination then began to decrease, and its value at the end of 1891 was 10° 45′·35. The first observation of the magnetic inclination at the Vatican was made in 1891. This element had been previously determined, however, in other parts of Italy by several observers. From 1859, when Secchi observed the inclination at the Roman College, up to the present time, the recorded values for various parts of Italy have been fairly numerous. Before 1859, however, very few observations were made. In 1640 an observer gave 65° 40′ as the inclination at Rome, and Humboldt obtained a value of 61° 57′ in 1806. Father Denza gives 58° 4′·6 as the inclination at the Vatican Observatory in 1891. A number of other matters are discussed in the volumes under notice, and many observations are included, upon which we have not been able to comment in this article. Enough has been said, however, to show that the observatory has furthered investigations in many branches of physical science, and, from the energetic character of the workers, we may confidently expect many more contributions to scientific knowledge.

R. A. GREGORY.

NOTES.

THE Bakerian lecture is to be delivered before the Royal Society by Prof. T. E. Thorpe, on the 22nd inst., the subject of the lecture being a research carried out by Mr. J. W. Rodger and himself on the relations between the viscosity (internal friction) of liquids and their chemical nature.

WE are requested to state that Mrs. Tyndall would be much indebted to any correspondents of the late Prof. Tyndall who have preserved his letters, if they would kindly lend them to her for use in the preparation of his biography. Any letters thus lent should be sent to her at Hind Head House, Haslemere, and would be returned safely to their owners.

A HYGIENIC laboratory has been established in the University of Bonn. The new institution will be under the direction of Prof. Finkler. According to the *British Medical Journal*, there is now no university in Prussia without a hygienic laboratory. From the same authority we learn that the Bengal branch of the Pasteur Institute was successfully inaugurated on January 30, in the presence of a large company.

THE Duke of York visited King's Lynn on Friday, and opened a new technical school built by the Corporation at a cost of £3,000.

THE order of S.S. Maurice and Lazarus has been conferred upon Sir Joseph Lister, M. Pasteur. and Prof. Virchow, by the King of Italy.

MR. HENRY O. FORBES has been selected by the Library Committee of the Liverpool Corporation for appointment as Director of the Liverpool Museums.

THE late Dr. J. K. Hasskarl, whose death we announced on January 25, has, says the *Chemist and Druggist*, bequeathed his library to the University of Strassburg, and his herbarium to the University of Leyden.

PROF. BILLROTH died at Abbazia, on February 6, at sixty-five years of age. He principally devoted his attention to military surgery, and published a number of valuable papers on that branch of his profession. It is said that during the last few months of his life he was engaged in completing a work upon the physiology of music.

WE regret to announce the death of Mr. Peter Redpath, a generous benefactor to science in Canada. Mr. Redpath took an active interest in the McGill College and University, Montreal, and in 1880 built, at his sole expense, a museum in connection with the University. This building, known as the Peter Redpath Museum, is used for the exhibition and study of specimens in geology, mineralogy, palaeontology, zoology, botany, and archæology. In October last, a library, capable of holding 130,000 volumes, and added to the University buildings through the liberality of Mr. Redpath, was opened in the presence of a large and influential gathering. The sums spent in erecting the museum and library are said to amount to nearly £75,000. Mr. Redpath died at Chislehurst on February 1, in his seventy-third year.

PROF. EDMOND FRÉMY died on Saturday, at Paris. We are indebted to the *Times* for the chief points in the following sketch of his career. The son of a professor of chemistry at St. Cyr, he was born at Versailles on February 28, 1814, and after studying with his father, became a teacher at the École Polytechnique. In 1857 he was elected into the Paris Academy of Sciences as successor of Baron Thénard. The amount of Frémy's scientific work is enormous. His first publications date from 1835; they relate to the precious metals, and attracted the attention of the scientific world. His investigations on ozone (in conjunction with Becquerel), on the ammoniacal bases of chrome and cobalt, on fluor spar and the reproduction of minerals, will remain classical. In organic chemistry, also, he made numerous important researches, and as manager of the Saint Cobain Works he superintended the manufacture of soda and sulphuric acid, the tempering of glass and steel, the refining of castings, &c. Not long ago he published, jointly with one of his pupils, M. Verneuil, a work, which was the fruit of years of study, on the artificial production of rubies. He was the author, with Pelouze, of a treatise on chemistry in six volumes, and in 1881 began the publication of a chemical encyclopædia.

IN addition to the names we gave last week, the *Lancet* says that the following are some of the principal delegates who have been appointed to represent the various Governments at the International Sanitary Conference which opened in Paris yesterday. Great Britain: Mr. Constantine Phipps and Dr. Thorne Thorne, C.B., F.R.S. British India: Surgeon-General Cuningham. France: M. Barrère, M. Hanotaux, Prof. Brouardel, Prof. Proust, and M. Monod. Germany: Herr von Schoen and Herr Mordtmann. Holland: Dr. Ruysch and M. de Stuers. Russia: M. Michel de Giers, together with technical delegates. Austria-Hungary: Count Kuefstein, Dr. Hagel, and Dr. Karliuski. Greece: M. Criésis and M. Vafiades. Italy: the Marquis de Malaspina and Dr. Pagliani. Portugal: M. Navarro. Sweden and Norway: M. Due. Turkey: Tuskan Bey, Nouri Pasha, Boukowski Pasha, and Dr. Haindy Bey. Persia: A delegate yet to be appointed by the Persian Ministry in Paris. Egypt: Achmet Pasha Choukry, M. Mieville, and Sedky Pasha. The remaining countries—Belgium, Denmark, and Spain—have not yet announced their delegates.

THE Executive Committee of the City and Guilds of London Institute have changed the name of the Guilds Central Institution, in Exhibition Road, South Kensington, to the Guilds Central Technical College.

THE gold medal of the Royal Astronomical Society has been awarded to Mr. S. W. Burnham for his discoveries of binary stars and researches in connection with them. At the annual general meeting of the society, to be held to-morrow, the proposal will be made that henceforth the meetings be held at